REMARKS

Claims 1-27 are pending in the application. Claims 1-27 are rejected. Claims 1-4 and 27 have been amended. No new matter has been introduced. In view of the foregoing amendments and the following remarks, Applicants respectfully request allowance of Claims 1-27.

35 USC § 112 REJECTIONS

Claims 5 and 6 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement by not disclosing in the specification the term "selective canceling." Applicants respectfully disagree, and point the Examiner to paragraph 52 of the specification, which states:

> While rate estimates may be met by quantizer adjustments for many rate control situations, in other situations quantizer control may be employed as part of an overall rate control solution which also may include **selective zeroing** of **DCT coefficients** and/or **motion vectors**…

(Present Application, para. 52). (Emphasis added). Applicants submit that selective zeroing and selective canceling effect the same result.

Claims 17-19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement by not disclosing in the specification the term "clipper." Applicants respectfully disagree, and point the Examiner to specification paragraphs 74, 124, 142, 144, and 147, all of which recite a similar definition of what it means to "clip." A portion of paragraph 147 is recited below:

> Any q_{del} value that exceeds the high threshold or is less than the low threshold will be clipped to the corresponding threshold.

(Present Application, para. 147). Applicants submit that a "clipper" performs the clipping function just described, which function is not limited to quantizer values.

PRIOR ART REJECTIONS

Claims 1-4 and 8-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hui (US 6,654,417 B1) in view of Chiang et al., A new rate Control Scheme Using Quadratic Rate Distortion Model, IEEE, 1996, pgs. 73-76. Claim 5 is rejected as obvious over Hui, Chiang and Vogel (US 5,343,247). Claim 6 is rejected as obvious over Hui, Chiang, and Suzuki (US 6,937,656 B2). Claim 7 is rejected as obvious over Hui, Chiang, and Sugiyama (US 6,940,911 B2). Claims 15-16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over

Hsia (US 2004/0146108 A1) in view of Chiang. Claims 17-19 and 20 are rejected as obvious over Hsia, Chiang, and Mitchell (US 6,256,422 B1). Claim 18 is rejected as obvious over Hsia, Chiang, Mitchell, and Hui. Claims 21-27 are rejected as obvious over Hui and Hsia.

CLAIMS 1-14 DEFINE OVER THE PRIOR ART

Currently amended independent claim 1 recites:

A rate control method, comprising, for a sequence of video data:

determining a target bitrate for a picture in the sequence based on an estimate of the picture's complexity,

generating a first quantizer estimate for the picture based on a fullness indicator from a transmit buffer of a video coder,

generating a second quantizer estimate for the picture based on a linear regression of quantizer assignments made to prior pictures of a same type, actual coding rates achieved by such quantizer assignments and the target bitrate, and

selecting a quantizer based on a difference between the two quantizer estimates and based on the estimate of the picture's complexity.

The combination of Hui and Chiang does not teach or suggest the rate control method recited in claim 1. In particular, the combination of Hui and Chiang does not teach at least determining a target bitrate for a picture in the sequence based on an estimate of the picture's complexity; generating a first quantizer estimate for the picture based on a fullness indicator from a transmit buffer of a video coder; or, selecting a quantizer based on a difference between the two quantizer estimates and based on the estimate of the picture's complexity. Regarding determining a target bitrate, the Examiner cites FIGS. 2 (222) and 3 (322) of Hui, neither of which shows as inputs to the Target Bitrate Estimate (blocks 222 and 322, respectively) ***an estimate of the picture's complexity***. While the Target Bitrate Estimator 322 shows an input from the Frame Quality Measure 320, the Frame Quality Measure 320 is not based on ***an estimate of the picture's complexity***, but rather a comparison between the Target Quality 319 and the Encoding Quality 324, where the Encoding Quality 324 is itself a comparison between the "original input picture taken from input 300 and the locally decoded picture 325." (Hui, FIG. 3, Col. 12, lines 1-8). Therefore, the Target Bitrate Estimate 322 is not based on ***an estimate of the picture's complexity***.

As teaching generating a first quantizer estimate for the picture based on a fullness indicator from a transmit buffer of a video coder, the Examiner cites the following from Hui:

> …where $D_{I,P,B}$ is ***virtual*** buffer fullness of corresponding I-, P-, or B-picture, updated (after coding each MB) by the difference between the bits used by the MB and the bits allocated to the MB based on the corresponding $T_{I,B,P}$…

(Hui, Col. 9, lines 30-34). (Emphasis Applicants'). Applicants respectfully disagree. The buffer referenced by Hui with respect to determining a reference quantization step size is a ***virtual*** buffer, not a ***transmit*** buffer as disclosed in the subject claim. Hui does disclose a transmit buffer, but it plays no role in determining quantization parameters: "The encoded bitstream is stored in an ***output buffer*** 207 of the encoder for output at 208 at desired data rates." (Hui, FIG. 2, Col. 8, lines 63-65). (Emphasis Applicants').

The Examiner cites part of the following passage from Hui as teaching selecting a quantizer based on a difference between the two quantizer estimates and based on the estimate of the picture's complexity:

> In one form of the invention, the method may include measuring an average quantization step-size for at least one previously encoded picture, predicting a bit rate for a previously encoded I-, P-, and B-picture, and determining said **target bit rate** based on **said predicted bit rate** and a difference between the target encoding quantization step-size and the measured average quantization step-size.

(Hui, Col. 3, lines 59-65). (Emphasis Applicants'). Hui does not disclose ***selecting*** a ***quantizer*** based on a difference between the two quantizer estimates ***and*** based on the ***estimate of the picture's complexity***.

For at least these reasons, Applicants believe that the rejection of claim 1 should be reconsidered and withdrawn. Claims 2-14 depend from independent claim 1 and are allowable for at least the reasons applicable to claim 1, as well as due to the features recited therein.

CLAIM 5 DEFINES OVER THE PRIOR ART

Dependent claim 5 recites:

> The rate control method of claim 1, further comprising selectively canceling transform coefficients of coded blocks in the picture according to a rate control policy selected for the picture.

The combination of Hui, Vogel and Chiang does not teach or suggest the rate control method recited in claim 5. The Examiner cites the following sentence of Vogel as teaching the subject claim: "Subsequently, the action of the transform unit 403 is cancelled by a unit 406 with the quantized sampling values." (Vogel, Col. 3, lines 61-63). Applicants respectfully disagree. Nothing in that sentence, or indeed anywhere in Vogel, teaches or suggests ***selectively***

canceling transform coefficients of coded blocks in the picture ***according to*** a ***rate control policy*** selected for the picture.

For at least these reasons, Applicants believe that the rejection of claim 5 should be reconsidered and withdrawn.

CLAIM 6 DEFINES OVER THE PRIOR ART

Dependent claim 6 recites:

> The rate control method of claim 1, further comprising selectively canceling motion vectors of coded blocks in the picture according to a rate control policy selected for the picture.

The combination of Hui, Suzuki and Chiang does not teach or suggest the rate control method recited in claim 6. The Examiner cites the following passage from Suzuki as teaching the subject claim:

> Since fine quantization is performed when the quantizing parameter QP is small, the above operation matches a tendency that the reduction effect of the amount of motion vector information is canceled by the increased amount of the coding information of the DCT coefficients.

(Suzuki, Col. 9, lines 14-19). Applicants respectfully disagree. The passage merely notes that the reduction effect of the amount of motion information is canceled by the increased amount of coding information of the DCT coefficients, which is not the same thing as ***selectively*** canceling motion vectors of coded blocks in the picture ***according to*** a ***rate control policy*** selected for the picture.

For at least these reasons, Applicants believe that the rejection of claim 6 should be reconsidered and withdrawn.

CLAIM 8 DEFINES OVER THE PRIOR ART

Dependent claim 8 recites:

> The rate control method of claim 1, further comprising selecting a coding mode for blocks of the picture according to a rate control policy selected for the picture.

The combination of Hui and Chiang does not teach or suggest the rate control method recited in claim 8. The passage of Hui cited by the Examiner as disclosing the subject claim does little more than recite descriptions of *I, P,* and *B* picture types; it does not teach ***selecting*** a coding mode for blocks of the picture ***according to a rate control policy selected for the picture***. (Hui, Col. 5, lines 58-67).

For at least these reasons, Applicants believe that the rejection of claim 8 should be reconsidered and withdrawn.

CLAIMS 15-20 DEFINE OVER THE PRIOR ART

Independent claim 15 recites:

> A rate controller, comprising:
>
> a scene content analyzer having an input for source video data and an output for complexity indicators representing complexity of each picture in the source video data,
>
> a first quantizer estimator having an input for the source video data and complexity indicators, to generate a quantizer estimate of a picture based on a calculation of a target rate for coding the picture,
>
> a second quantizer estimator having an input for the complexity indicators and past values of quantizer selections and coding rates achieved therefrom, the second quantizer estimator to generate a second quantizer estimate for the picture based on a linear regression modeling of the prior quantizer selections and coding rates for like-kind pictures, and
>
> a coding adapter, having inputs for the two quantizer estimates and the complexity indicators to select a quantizer for the picture based on a difference of the two quantizer estimates.

The combination of Hsia and Chiang does not teach or suggest the rate controller as recited in claim 1. In particular, the combination of Hsia and Chiang does not teach at least a scene content analyzer having an input for source video data and an output for complexity indicators representing complexity of each picture in the source video data. The Examiner cites the Scene Detection Module, Quantization Decision Module, and Picture Type Decision Module of FIG. 3 as disclosing the scene content analyzer, however, none of these modules discloses an output for complexity indicators representing complexity of each picture in the source video data. (Hsia, FIG. 3, paras. 44-46). The Picture Type Decision Module outputs the picture type of the current frame (Hsia, FIG. 3, para. 43); the Quantization Decision Module outputs a quantization scale for each slice (Hsia, para. 44); and the Scene Detection Module outputs either a low or high scd signal depending on whether a scene change is detected (Hsia, FIG. 3, paras. 43 and 45).

The Examiner asserts also that Hsia's Quantization Decision Module discloses both the first and second quantizer estimators of the subject claim. Applicants respectfully disagree. First, the Quantization Decision Module is concerned with quantization scales for ***slices of pictures***, and not quantization estimates of ***pictures***. Moreover, the Quantization Detection Module outputs only a single quantization scale (i.e., *Q_Slice*) for each slice, not ***two***, separately-derived quantization estimates for each picture as is recited in the subject claim.

(Hsia, para. 44). Second, the Quantization Decision Module does not have an input for the complexity indicators and past values of quantizer selections and coding rates achieved therefrom.

Finally, Hsia does not teach a coding adapter, having inputs for the two quantizer estimates and the complexity indicators to select a quantizer for the picture based on a difference of the two quantizer estimates. While the Scene Change Detection block of the Scene Detection Module takes two quantizer values as two of its four inputs, it does not select a quantizer for the picture based on a difference of the two quantizer estimates, but rather determines whether there has been a scene change. (Hsia, FIG. 3, para. 45).

For at least these reasons, Applicants believe that the rejection of claim 15 should be reconsidered and withdrawn. Claims 16-20 depend from independent claim 15 and are allowable for at least the reasons applicable to claim 15, as well as due to the features recited therein.

CLAIM 17 DEFINES OVER THE PRIOR ART

Dependent claim 17 recites:

The rate controller of claim 15, wherein the coding adapter comprises:
a subtractor having inputs for the two quantizer estimates, and
a clipper coupled to an output of the subtractor.

The combination of Hsia, Mitchell and Chiang does not teach or suggest the rate controller recited in claim 17. The Examiner cites the Scene Detection Module in FIG. 3 of Hsia as teaching a subtractor having inputs for two quantizer estimates, however, the only block shown in the Scene Detection Module as having inputs for two quantizer estimates is the Scene Change Detection block, which ***detects a scene change*** – it is not a ***subtractor***. (Hsia, FIG. 3, para. 45).

Also, the Examiner cites FIG. 11(a) of Mitchell as teaching a clipper coupled to an output of the subtractor, however, Mitchell actually shows the opposite structure (i.e., the output of a "clipper" as an input to a "subtractor"). (Mitchell, FIG. 11(a), Col. 13, lines 28-61).

For at least these reasons, Applicants believe that the rejection of claim 17 should be reconsidered and withdrawn.

CLAIM 20 DEFINES OVER THE PRIOR ART

Dependent claim 20 recites:

> The rate controller of claim 15, wherein the coding adapter comprises a lookup table indexed by a complexity indicator representing complexity of the picture and the picture's coding type.

The combination of Hsia, Mitchell and Chiang does not teach or suggest the rate controller recited in claim 20. The Examiner cites the following from Mitchell as teaching a lookup table indexed by a complexity indicator representing complexity of the picture and the picture's coding type:

> The quantization described in the background is the linear quantization used in international image data compression standards such as JPEG and MPEG. There is no requirement that the quantization be linear. Any mapping that reduces the number of transform data levels in a deterministic way can be used with this invention. […] Actual embodiments may use a lookup table or a sequence of comparisons to achieve similar results.

(Mitchell, Col. 6, lines 26-34). Nowhere in Mitchell is it taught that the lookup table is indexed by a ***complexity indicator representing complexity of the picture and the picture's coding type***.

For at least these reasons, Applicants believe that the rejection of claim 20 should be reconsidered and withdrawn.

CLAIMS 21-26 DEFINE OVER THE PRIOR ART

Independent claim 21 recites:

> A method for identifying a scene change from a sequence of video data, comprising:
>
> for a plurality of macroblocks of an input picture, computing variances of a plurality of blocks therein,
>
> **comparing minimum variance values of the plurality of macroblocks to corresponding minimum variance values of macroblocks from a prior picture,**
>
> calculating an activity level of the input picture from the variances,
>
> comparing the activity level of the input picture to an activity level of the prior picture, and
>
> **generating a scene change decision from the two comparisons.**

The combination of Hui and Hsia and does not teach or suggest the method for identifying a scene change as recited in claim 21. In particular, the combination of Hui and Hsia does not teach at least comparing minimum variance values of the plurality of macroblocks to corresponding minimum variance values of macroblocks from a prior picture; or, generating a scene change decision from the two comparisons. Nowhere in Hui is it taught to compare

minimum variance values of the plurality of macroblocks to corresponding ***minimum*** variance values of macroblocks from a prior picture. Further, Hsia fails to teach generating a scene change decision from the two comparisons as described in the subject claim. Therefore, the combination of Hui and Hsia fails to teach or suggest each and every element of claim 21.

Applicants note that dependent claims 22-24 recite explicitly the ***minimum*** variance values of claim 21, with respect to comparisons thereof and their use in calculating activity levels.

For at least these reasons, Applicants believe that the rejection of claim 21 should be reconsidered and withdrawn. Claims 22-26 depend from independent claim 21 and are allowable for at least the reasons applicable to claim 21, as well as due to the features recited therein.

CLAIM 27 DEFINES OVER THE PRIOR ART

Currently amended independent claim 27 recites:

A scene change detector, comprising:

a variance calculator to calculate a plurality of variance values for each macroblock in a source image,

a minimum variance selector to select a minimum variance value for each macroblock,

a memory to store minimum variance values of a previously processed image,

a comparator to compare the minimum variance values of the source image to the minimum variance values of the previously processed image,

an averager to calculate an average variance value for each macroblock,

an activity calculator to calculate an activity level of the source image from the average variance values, and

decision logic to signal a scene change based on a comparison of an output from the comparator and the activity level of the source image.

The combination of Hui and Hsia does not teach or suggest the scene change detector as recited in claim 27. In particular, the combination of Hui and Hsia does not teach at least a minimum variance selector to select a minimum variance value for each macroblock. As discussed above in conjunction with claim 21, nowhere in Hui is a ***minimum*** variance selector taught to select a ***minimum*** variance value for each macroblock. Similarly, Hui also does not teach a memory to store ***minimum*** variance values of a previously processed image, or a

comparator to compare the ***minimum*** variance values of the source image to the ***minimum*** variance values of the previously processed image.

Furthermore, Hsia fails to teach decision logic to signal a scene change based on a comparison of an output from the comparator and the activity level of the source image. The Examiner cites Hsia's Picture Type Decision Module as teaching this element, however Applicants fail to find such a showing. (Hsia, FIG. 3). As described in paragraph 43 of Hsia, the Picture Type Decision Module takes ***as an input*** a signal from the Scene Detection Module indicating that a scene change has been detected; it does not output such a signal. The Scene Detection Module of Hsia does signal a scene change, however, said signal is not based on a comparison of an output from the comparator and the activity level of the source image, as described in the claim. (Hsia, FIG. 3, para. 45).

For at least these reasons, Applicants believe that the rejection of claim 27 should be reconsidered and withdrawn.

CONCLUSION

In view of the above amendments and arguments, it is believed that the above-identified application is in condition for allowance, and notice to that effect is respectfully requested. Should the Examiner have any questions, the Examiner is encouraged to contact the undersigned at (408) 975-7963.

The Commissioner is authorized to charge any fees or credit any overpayments which may be incurred in connection with this paper under 37 C.F.R. §§ 1.16 or 1.17 to Deposit Account No. 11-0600.

Respectfully submitted,

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